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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LEUNG, WAI LUN	
ART UNIT	**PAPER NUMBER**
2613	

DATE MAILED: 05/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/781,900	KADO ET AL.	
	Examiner	Art Unit	
	Danny Wai Lun Leung	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 March 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 3/2/2006 have been fully considered but they are not persuasive.

2. In remarks filed 3/2/2006, applicant argues, regarding to claim 1, that:

a. Grubb's method of dynamic controlling of pump energy does not inherently include calculating.

In col 7, lines 14-57 of Grubb, it is clearly explained, in terms of experimental procedures, that calculating a combination of optical power at two or more different pumping wavelengths for pumping lights used in backward pumping is performed, so as to provide a substantially flat Raman gain within a predetermined signal wavelength band. In particular, the wavelength ranges are 1530-1565nm (col 7, ln 17-18), with predicted performance of +/-0.12dB and +/-0.342dB as shown in fig 7 & 8, (col 7, ln 19-20). Whereas in order to generate a gain vs. wavelength graph such as that of fig 7 & 8, calculation of optical power at each of the respective wavelengths are inherently required. Where a substantially flat Raman gain is shown on fig 7 as curve a.

Col 7, ln 48-57 further explains that different signal varying devices 12 can be varied to compensate for individual device signal variation profile non-uniformities and provide a cumulative signal variation profile that is substantially more uniform than the individual device profiles. Where calculation is inherently

necessary in order to perform accurate compensation in attempt for correcting signal variation profile to be more uniform as disclosed by Grubb.

b. Grubb neither teaches nor suggests the additional features of carrying out bidirectional pumping followed by changing pumping power distribution over wavelength for bidirectional pumping.

Applicant is directed to fig 5 of Grubb, which shows a configuration of bidirectional pumping, where changing pumping power distribution over wavelength for bidirectional pumping is clearly explained in col 7, ln 14-57.

c. Grubb's method "does not distinguish between purposely changing from backward pumping, to bidirectional pumping, and then changing the respective distribution of pump power after bidirectional pumping is performed."

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., **purposely changing from backward pumping**, to bidirectional pumping, and then changing the respective distribution of pump power **after bidirectional pumping is performed**.) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

d. Grubb's method "does not disclose the combination of steps, namely calculating optical power in backward pumping, then carrying out bidirectional pumping, and then changing the respective distribution of pumping power for the bidirectional pumping."

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the combination of steps, namely calculating optical power in backward pumping, **then** carrying out bidirectional pumping, and **then** changing the respective distribution of pumping power for the bidirectional pumping.) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

As shown in Grubb's fig 5, a bidirectional pumping configuration is disclosed, which includes a portion *(32, 36, and 38)* for backward pumping. Grubb's disclosure teaches a Raman amplification method for pumping WDM signal light within an optical fiber *(40, fig 5)*, that uses pumping lights having two or more different pumping wavelengths *(λ_{p1}, λ_{p2}, λ_{pm}, fig 5; 1530-1565nm, col 7, ln 17)*, comprising steps of: calculating a combination of optical power at said two or more different pumping wavelengths for said pumping lights in backward pumping *(col 7, ln 15-57)* so as to provide a substantially flat Raman gain within a predetermined signal wavelength band *(col 6, ln 19-22; col 7, ln 7; fig 7, fig 8)*; carrying out bidirectional pumping with at least part of said pumping lights wherein said bidirectional pumping includes said backward

pumping *(col 5, ln 19-30; fig 5)*; and changing a respective distribution of pumping power to wavelength of said bidirectional pumping *(col 6, ln 10-13; col 7, ln 48-57)*.

Therefore, 102 rejection for claim 1 is hereby maintained in this office action, with additional clarification that explains how Grubb's disclosure reads on the claim.

3. Applicant has not presented any arguments regarding to the specific limitations of claims 2-36, other than the fact that it depended upon claim 1. As such, 102 rejections for claims 2, 17, and 32, as well as 103 rejections for claims 3-16, 18-31, and 33-35 are hereby maintained in this office action in its original form. Grounds of 103 rejection for claim 36 is also maintained, with added citations from the same references in view of applicant's amendment.

4. The objections to the disclosure and to the claims are hereby withdrawn in accordance to applicant's amendment to the abstract, and the replacement of spelled out "laser diode" in the specification and in the claims.

5. The use of the trademark iGM has been noted in this application. Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks.

6. The 112 rejections are hereby withdrawn in view of applicant's amendment to claim 36.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1, 2, 17, and 32 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Number 6,282,002 to Grubb et al.

Regarding to claim 1, Grubb's disclosure teaches a Raman amplification method for pumping WDM signal light within an optical fiber *(40, fig 5)*, that uses pumping lights having two or more different pumping wavelengths *(λ_{p1}, λ_{p2}, λ_{pm}, fig 5; 1530-1565nm, col 7, ln 17)*, comprising steps of: calculating a combination of optical power at said two or more different pumping wavelengths for said pumping lights in backward pumping *(col 7, ln 15-57)* so as to provide a substantially flat Raman gain within a predetermined signal wavelength band *(col 6, ln 19-22; col 7, ln 7; fig 7, fig 8)*; carrying out bidirectional pumping with at least part of said pumping lights wherein said bidirectional pumping includes said backward pumping *(col 5, ln 19-30; fig 5)*; and changing a respective distribution of pumping power to wavelength of said bidirectional pumping *(col 6, ln 10-13; col 7, ln 48-57)*.

As to claim 2, Grubb further discloses wherein: a total optical power of said bidirectional pumping is not changed from the combination of optical power of said backward pumping calculated in said calculating step (col 6, ln 13-14).

As to claims 17 and 32, Grubb further discloses the method further comprising: performing forward pumping with at least one multi-mode pumping laser having a laser diode with a grating structure (col 6, ln 45-53).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 3-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Number 6,282,002 to Grubb et all, as applied to claims 1 and 2 above, in view of European Patent Application Number 1102114 to Emori et al.

Regarding to claims 3 and 18, Grubb discloses the method for pumping in accordance to claims 1 and 2 as discussed above. Grubb does not disclose expressly that the method uses all of said pumping lights for backward pumping and part of said pumping lights for forward pumping. Emori, from the same field of endeavor, teaches all pumping lights are used for backward pumping and part of said pumping lights are used for forward pumping (col 13, ln 26-47; as shown in fig 7, second pump light is used for forward pumping, while both first pump light and second pump light is used for backward pumping). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to modify Grubb's pump light distribution method such that the method uses all of said pumping lights for backward pumping and part of said pumping lights for forward pumping as taught by Emori. The motivation for

doing so would have been to easily control the intensity distribution of the optical signal along the longitudinal direction of the optical fiber (Emori, col 13, ln 45-47).

Regarding to claims 4, 11, 26, and 19, Grubb discloses the method for pumping in accordance to claims 1 and 2 as discussed above; the combination of Grubb and Emori teaches the method for pumping in accordance to claims 3 and 18 as discussed above. Grubb does not disclose expressly that the method require the shorter wavelengths of said pumping lights are used for forward pumping. Emori further teaches wherein: shorter wavelengths of said pumping lights are used for forward pumping (col 14, ln 48-50; wavelength λ_{p1} of the first pump light, which is 1450nm, along with wavelength λ_{p2} of the second pump light, which is 1350nm, are used for backward pumping; while wavelength λ_{p2} of the second pump light, which is 1350nm, the shorter of the two, is also used for forward pumping). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to incorporate Emori's teaching in which the shorter wavelengths of the pumping lights to be used for forward pumping into Grubb's pumping method or the combination of Grubb and Emori's pumping method. The motivation for doing so would have been to be able to use the forward pump to amplify the backward pump (Stentz, col 3, ln 55-58).

Regarding to claims 5, 8, 12, 15, 20, 23, 27, and 30, Grubb discloses the method for pumping in accordance to claims 1 and 2 as discussed above; the combination of Grubb and Emori teaches the method for pumping in accordance to claims 3, 4, 11, 18, 26, and 29 as discussed above. Grubb does not disclose expressly that the method requires the combination of optical power of backward pumping is larger than that of forward pumping. Emori further discloses wherein: the combination of optical power of backward pumping is larger than that of

forward pumping (col 14, ln 33-39; forward pumping energy is 300mW, while backward pumping is 300mW + 25mW). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to incorporate Emori's teaching in which the combination of optical power of backward pumping is larger than that of forward pumping into Grubb's pumping method or the combination of Grubb and Emori's pumping method. The motivation for doing so would have been to further improve noise property (Emori, col 14, ln 17-18).

Regarding to claims 6, 7, 9, 10, 13, 16, 21, 22, 24, 25, 28, 29, 31, Grubb further discloses the method further comprising: performing forward pumping with at least one multi-mode pumping laser having a laser diode with a grating structure (col 6, ln 45-53).

11. Claims 11, 14, 26, 29, 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Number 6,282,002 to Grubb et al, as applied to claims 1, 2, 17, and 32 above, in view of US Patent Number 6,163,636 to Stentz et al.

Regarding to claims 26 and 11, Grubb discloses the method for pumping in accordance to claim 1 and 2 as discussed above. Grubb does not disclose expressly that the method uses shorter wavelengths for forward pumping. Stentz, from the same field of endeavor, teaches a pumping method of using shorter wavelengths of said pumping lights are used for forward pumping (col 5, ln 20-32; where the shorter wavelength 1345nm is used for 2^{nd} order pump, which is co-propagating, or forward pumping). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to incorporate the method of using shorter wavelength for forward pumping as taught by Stentz, onto Grubb's method of pumping.

The motivation for doing so would have been to be able to use the forward pump to amplify the backward pump (Stentz, col 3, ln 55-58).

As to claims 14 and 29, Grubb further discloses the same limitation as discussed above regarding 17 and 32.

Regarding to claim 33 and 34, Grubb discloses an optical transmission system that transmits a WDM optical signal (output of multiplexer 26, fig 2) through an optical transmission path (30, fig 2) comprising: an optical transmitter (16, fig 2) configured to output said WDM optical signal into said optical transmission path; two or more Raman amplifiers that are connected to said optical transmission path in series (32, fig 2), and configured to Raman-amplify said WDM optical signal (col 5, ln 1-10); and an optical receiver (18, fig 2) configured to receive said WDM optical signal propagated through said optical transmission path. Grubb does not disclose expressly wherein: at least one of said two or more Raman amplifiers is configured to adjust a wavelength characteristic of noise figure to provide a predetermined wavelength characteristic of noise figure for receiving said WDM optical signal at said optical receiver. Stentz, from the same field of endeavor, teaches wherein: at least one of said two or more Raman amplifiers is configured to adjust a wavelength characteristic of noise figure to provide a predetermined wavelength characteristic of noise figure for receiving an optical signal at an optical receiver (col 4, ln 24-27). As to claim 34, Stentz further discloses wherein one of said Raman amplifiers is configured to adjust a wavelength characteristic of noise figure ("selecting the center wavelength", col 4, ln 45-54) by way of bidirectional pumping (col 4, ln 55-63; where first order pump 20A, fig 7, is in the counter-propagating direction, or backward pumping; while second order pump 20B, fig 7, is in the co-propagating direction, or forward

pumping). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to use Stentz's bi-directional Raman pump on Grubb's optical transmission system such that the noise figure in Grubb's system can be adjusted by using Stentz bi-directional Raman pumps, and be received by Grubb's receiver. The motivation for doing so would have been to achieve significant Raman gain throughout the transmission span in Grubb's WDM optical transmission system, thereby minimizing power excursion of the signals, and reduce system impairments due to optical nonlinearities (Stentz, col 5, ln 1-10).

12. Claims 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Number 6,282,002 to Grubb et al, in view of US Patent Number 6,163,636 to Stentz et al., as applied to claims 33 and 34 above, and further in view of European Patent Application Number 1102114 to Emori et al.

Regarding to claim 35, the combination of Grubb and Stentz discloses the optical transmission system as discussed above regarding claim 34. It does not disclose expressly where in: all pumping lights in said Raman amplifier are used for backward pumping and shorter wavelengths of the pumping lights are used for forward pumping. Emori, from the same field of endeavor, teaches an optical transmission system where in: all pumping lights in said Raman amplifier are used for backward pumping (col 13, ln 26-47; as shown in fig 7, second pump light is used for forward pumping, while both first pump light and second pump light is used for backward pumping) and shorter wavelengths of the pumping lights are used for forward pumping (col 14, ln 48-50; wavelength λ_{p1} of the first pump light, which is 1450nm, along with wavelength λ_{p2} of the second pump light, which is 1350nm, are used for backward pumping;

while wavelength λ_{p2} of the second pump light, which is 1350nm, the shorter of the two, is also used for forward pumping). Therefore, it would have been obvious for a person of ordinary skill in the art at the time of invention to modify the combination of Grubb and Stentz's pump light distribution system such that the system uses all of said pumping lights for backward pumping and shorter wavelengths of the pumping lights for forward pumping as taught by Emori. The motivation for doing so would have been to easily control the intensity distribution of the optical signal along the longitudinal direction of the optical fiber (Emori, col 13, ln 45-47).

Regarding to claim 36, Stentz further discloses wherein the wavelength characteristic of noise figure at said shorter wavelength is due to the backward pumping (col 5, ln 1-2, in which only little noise from the second-order pump, the forward pump, is transferred to the signal; which implies that most of the noise are due to the backward pump), and the backward pumping substantially provides a Raman gain (fig 4B shows that the noise figure due to only backward pump (a) has a same wavelength characteristic as the bi-directional gain (b), *col 4, ln 25-45*), and is approximately the same as a gain for when bidirectional pumping is performed with lights for forward pumping turned on *(as shown in fig 4B, curve a and curve b are approximately the same, where curve a is resulted from solely on backward pump, and curve b is resulted from both pumps)*.

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Danny Wai Lun Leung whose telephone number is (571) 272-5504. The examiner can normally be reached on 9:30am-7:00pm Mon-Thurs.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571) 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DWL
May 8, 2006

KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER